CLAIMS

What is claimed is:

1. An orthogonal frequency division multiplexing (OFDM)-based synchronization detection apparatus, comprising:

a 2^n level quantizing unit quantizing received data samples into levels of 2^n, where n is an integer greater than or equal to zero (0);

a delaying unit delaying the data samples quantized through the 2^n level quantizing unit by a predetermined number of clocks and outputting data indicative thereof;

a shifting unit shifting the output data samples of the 2^n level quantizing unit by an amount corresponding to an exponent of the output data of the delaying unit; and

a peak detecting unit detecting a peak value from sums of outputs from the shifting unit.

2. The OFDM-based synchronization detection apparatus according to claim 1, wherein the 2^n level quantizing unit proportionally magnifies the received data samples by values of 2^n, and converges the proportionally magnified data samples to 2^m levels, where m = 0, 1, 2, ... n.

3. The OFDM-based synchronization detection apparatus according to claim 2, wherein the proportional magnification of the received data comprises scaling of samples $r(k)$ to obtain scaled samples x in accordance with the following equation:

$$x = \frac{2^n r(k)}{\max r(k)}$$

4. The OFDM-based synchronization detection apparatus according to claim 3, wherein a convergence comprises converging the scaled samples x in accordance with the following equation:

$$Q_L(x) \cong \begin{cases} 2^{[\log_2 x]}, & x > 0 \\ 0, & x = 0 \end{cases}$$

where $[\log_2 x]$ is an integer mostly approximate to $\log_2 x$.

5. An orthogonal frequency division multiplexing (OFDM)-based synchronization detection method, comprising :

quantizing received data samples into levels of 2^n ;

delaying the quantized data samples by a predetermined numbers of clocks;

shifting the quantized data samples by an amount corresponding to an exponent of the delayed data and outputting shifting results indicative thereof; and

detecting synchronization using the shifted results.

6. The OFDM-based synchronization detection method according to claim 5, wherein the quantization comprises:

proportionally magnifying coefficients by values of 2^n, and converging the proportionally magnified coefficients to levels of 2^m, where m = 0, 1, 2 ... n.

7. The OFDM-based synchronization detection method according to claim 6, wherein the proportional magnification comprises:

scaling the samples $r(k)$ to yield scaled samples x in accordance with the following equation:

$$x = \frac{2^n r(k)}{\max r(k)}$$

8. The OFDM based synchronization detection method according to claim 7, wherein the convergence comprises:

converging the scaled samples x in accordance with the following equation:

$$Q_L(x) \cong \begin{cases} 2^{[\log_2 x]}, & x > 0 \\ 0, & x = 0 \end{cases}$$

where $[\log_2 x]$ is an integer mostly approximate to $\log_2 x$.

9. An orthogonal frequency division multiplexing (OFDM)-based synchronization detection apparatus, comprising:

a 2^n level quantizing unit quantizing received data samples into levels of 2^n;

a delaying unit delaying the quantized data samples by a predetermined number of clocks;

a complex conjugate extracting unit extracting complex conjugates of the delayed quantized data samples;

an n-bit shifting unit shifting quantized outputs q(k) from the 2^n level quantizing unit by an amount corresponding to a value of extracted complex conjugates;

an integer extracting unit extracting integer parts from the shifted quantized outputs q(k) and outputting L outputs indicative thereof;

a moving sum calculating unit summing up consecutively the L outputs at every clock; and

a peak detecting unit detecting a maximum value among the summing up of the consecutive L outputs to determine a synchronization of timing.

10. The OFDM-based synchronization detection apparatus according to claim 9, wherein the 2^n level quantizing unit quantizes the received data samples into a maximum of 2^n levels.

11. The OFDM-based synchronization detection apparatus according to claim 10, wherein the quantized 2^n levels are defined as quantizing data levels of exponents of 2.

12. The OFDM-based synchronization detection apparatus according to claim 9, wherein the quantized outputs $q(k)$ are represented by a quantization function Q_L, where a sample $\max r(k)$ having a largest value among the samples $r(k)$ is 2^n, and other samples $r(k)$ are proportionally magnified or scaled, as follows:

$$q(k) = Q_L\left[\frac{2^n r(k)}{\max r(k)}\right].$$

13. The OFDM-based synchronization detection apparatus according to claim 12, wherein $Q_L[x]$ represents a complex quantization to quantize the scaled samples $r(k)$ into levels of 2^i in accordance with the following equation:

$$Q_L[x] \cong Q[\mathrm{Re}\{x\}] + jQ[\mathrm{Im}\{x\}]$$

14. The OFDM-based synchronization detection apparatus according to claim 12, wherein $Q_L[x]$ represents a complex quantization to quantize the scaled samples $r(k)$ into levels of 2^i in accordance with the following equation:

$$Q_L(x) \cong \begin{cases} 2^{[\log_2 x]}, & x > 0 \\ 0, & x = 0 \end{cases}$$

15. The OFDM-based synchronization detection apparatus according to claim 12, wherein the moving sum calculating unit calculates correlation values according to the following equation:

$$\Lambda(n) = \sum_{k=1}^{n+L} \{q(k) << l(k-N)\}$$

$$l(k-N) = \log_2 q^*(k-N)$$

where the term $q(k) << l(k-N)$ represents a shift of the quantized value $q(k)$ to the left bit location by $l(k-N)$ bits, and $l(k-N) = \log_2 q^*(k-N)$ represents a transformation of the quantized 2^n level samples $q^*(k-N)$ into the values of $l(k-N)$, which are values of exponents extracted from the 2^n level quantized samples.